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Filed : January 16, 2004

REMARKS

Examiner rejected Claims 1, 2, 4, 16-19, and 33-39 as being anticipated under 35 U.S.C. §102(e) by Noble, et al., (U.S. Patent No. 6,450,116). Claims 3, 4, 15, 20-26, 29-32, 40 were rejected under 35 U.S.C. §103(a) as obvious over Noble in view of Iyer (U.S. Patent No. 6,498,109). Claims 5-10 were rejected under 35 U.S.C. §103(a) as obvious over Noble in view of Fujimura (U.S. Patent No. 4,718,976). Additionally, Claims 27-28 and 41-44 were rejected as being obvious under 35 U.S.C. §103(a) over the combination of Noble and Iyer, in further view of Fujimura. Further, the Examiner has rejected Claims 5, 27, and 41 under 35 U.S.C. 112, second paragraph, for indefiniteness of the term "through flow type."

Applicant respectfully traverses these rejections, and requests allowance in view of the foregoing amendments and remarks discussed below.

Indefiniteness Rejections

The Examiner has rejected Claims 5, 27, and 41 for indefiniteness of the term "through flow type." Applicants have removed the word "type" from these Claims, and believe the rejection should be withdrawn.

Restriction Requirement

In the office action, the Examiner required an election of species, stating that Claim 1 was generic to the following species:

Species 1, Fig. 1, pages 12-17;

Species 2, Fig. 2, page 17;

Species 3, Fig. 3, pages 17-25; and

Species 4, Fig. 5, pages 25-31.

Applicant confirms the oral election of Species 4 (Fig. 5), Claims 1-10 and 14-44. This election is now made without traverse.

Anticipation Rejections

Examiner rejected Claims 1, 2, 4, 16-19, and 33-39 as anticipated by Noble. Noble discloses an "apparatus for exposing a substrate to plasma radicals." Applicant respectfully traverses this rejection.

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As Examiner notes, the apparatus of Noble uses a rapid thermal processing (RTP) chamber, rather than a CVD chamber. (Office Action at p.4) In reference to FIG. 3A, which is cited by Examiner, the specification of Noble states that the “apparatus or system includes a rapid thermal processing (RTP) apparatus 200.” (Noble, col. 6, lines 55-56) RTP chambers are not CVD chambers. RTP is configured to modify the properties of films previously deposited, while a CVD chamber is configured to deposit a film.

Noble does not disclose a chemical vapor deposition (CVD) chamber as claimed in the rejected claims. Claim 1 recites a “chemical vapor deposition (CVD) device” in the preamble; Claim 33 recites “a plasma chemical vapor deposition (CVD) device.” The preamble defines the structure of the CVD device recited in the elements. In this case, the preamble breathes life and meaning into the claim. “Any terminology in the preamble that limits the structure of the claimed invention must be treated as a claim limitation.” M.P.E.P. 2111.02 See In re Stencel, 4 U.S.P.Q.2d 1071, 1073 (Fed. Cir. 1987). Here, the structure is limited to a CVD device by the preamble. These aspects recited in the preamble must be considered in the construction of the claim.

However, in order to expedite the prosecution, Claim 1 has been amended to recite “the plasma discharge chamber comprises an aluminum alloy” (*Emphasis added*) Similarly, Claim 33 now recites a “*a power source*, connected to the remote plasma discharge chamber, that applies power to the remote plasma discharge chamber of between about 500 W and 3,000 W *with a frequency of between about 300 kHz and 500 kHz.*” (*Emphasis added*). Support for these amendments is found in the specification. “The remote plasma discharge chamber 13 is preferably made of anodized aluminum alloy.” (Specification, paragraph 95) In paragraph 80 of the present specification, “radio-frequency output from 300 kHz to 500 kHz is applied to the flowing cleaning gas.”

The present application states that “use of radio-frequency (e.g., 400kHz) oscillating output allows manufacturing the remote plasma discharge chamber from anodized aluminum alloy.” (Paragraph 19) In contrast, Noble uses an energy source with a magnetron capable of producing 2.54 GHz microwave energy. (Noble, col 12, lines 9-11).

Noble also does not describe a CVD chamber capable of removing solids adhered to the chamber walls. Claim 1 states that “activated cleaning gas is brought into the inside of the

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reaction chamber through the piping and changes solid substances adhered to the inside of the reaction chamber.” Noble is directed to a device for “exposing a substrate to plasma.”

Claim 20 recites that the “device is capable of removing silicon nitride deposits adhered to the walls of the reaction chamber at a rate of greater than or equal to about 2.0 microns/minute when the power source communicates energy with a power of less than about 3,000 W.” Noble does not disclose a device capable of such an etch rate at less than 3,000 W, particularly on the walls of the chamber.

Anticipation requires that each and every element of the claimed invention be disclosed in a single prior art reference. *Akzo N.V. v. U.S. Int’l Trade Comm’n*, 808 F.2d 1471, 1 U.S.P.Q. 2d 1241 (Fed. Cir. 1986), cert. denied, 482 U.S. 909 (1987). The Noble reference does not meet all of the elements of independent Claims 1 and 33, thus these claims are not anticipated. Dependent Claims 2, 4, 16-19, and 34-39 add features of particular utility to allowable Claims 1 and 33 and contain every limitation the respective independent claims. Thus, these claims are also allowable over the Noble reference.

Obviousness Rejections

Claims 3, 4, 15, 20-26, 29-32, 40 were rejected under 35 U.S.C. §103(a) as obvious over Noble in view of Iyer. Applicant also respectfully traverses these rejections. Iyer discloses a plasma etching system, not a CVD chamber. As noted above, the recitation of a CVD chamber in the preambles of independent Claims 1 and 20 breathes life and meaning into the claims, and must be considered as a structural limitation under MPEP 2111.02.

Even if the combination is assumed to be suggested, no prima facie case for obviousness has been presented. The Examiner has not shown that the combination yields every limitation of the claims. Neither Iyer nor Noble teaches a CVD device as recited in independent Claims 1 and 20. Examiner states that it “would have been obvious for one of ordinary skill in the art at the time of the invention to employ the plasma energy source as taught by Iyer in the apparatus of Noble et al as an art recognized equivalent of creating reactive species.” (Office Action at 8) However, neither the apparatus of Noble nor the chamber used in Iyer are a chemical vapor deposition device as claimed in Claims 1, 20, and 33. E

Examiner has also not shown that the combination of Noble and Iyer teaches “activated cleaning gas is brought into the inside of the reaction chamber through the piping and changes

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solid substances adhered to the inside of the reaction chamber” as recited in Claim 1. Iyer teaches an apparatus for etching a substrate. Any remaining byproducts are removed during the process, and do not adhere to the chamber walls. “The organometallic byproducts 36 thus formed have low vapor pressures and can then be easily removed by pumping them out of etch chamber 22.” (Iyer, col 5, lines 6-9.

Iyer does not remedy the deficiencies of the Noble reference with respect to Claims 1, 20, and 33. Because Claims 3, 4, 15, 21-26, 29-32, and 40 add features of particular utility, these claims are also allowable.

Claims 5-10 were rejected under 35 U.S.C. §103(a) as obvious over Noble in view of Fujimura (U.S. Patent No. 4,718,976). Applicant respectfully traverses the rejections because Fujimura does not remedy the deficiencies of Noble with respect to independent Claim 1.

In addition to being focused upon a device for etching rather than CVD, Fujimura does not disclose a device where “activated cleaning gas is brought into the inside of the reaction chamber through the piping and changes solid substances adhered to the inside of the reaction chamber.” Rather, Fujimura is directed to a device for treating the substrate. The plasma is directed specifically at the substrate, rather than being configured to remove the substances on the chamber walls. Thus, Fujimura does not remedy the deficiencies of Noble.

However, in order to expedite the prosecution, Applicant has amended Claim 1, which Claims 5-10 are dependent upon, to recite “wherein the plasma discharge chamber comprises an aluminum alloy.” Fujimura states that the plasma is “activated by irradiating it with microwaves at a frequency of 2.45 GHz.” At these frequencies, sapphire or quartz must be used for the remote chamber. However, when using low frequency RF power, “it is unnecessary to use sapphire or quartz, which are required when conventional microwave output is used.” (Specification, paragraph 19). This further limitation provides further distinction over the combination of Noble and Fujimura. Claim 1 is not obvious over the combination of Noble and Fujimura, thus dependent Claims 5-10 are also allowable.

Finally, Claims 27-28 and 41-44 were rejected as being obvious over the combination of Noble and Iyer as applied to Claim 20 and in further view of Fujimura.

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As discussed above, Applicant traverses the rejection of Claim 20 over the combination of Noble and Iyer. Neither of these references discloses a plasma CVD device. Also, As discussed above Claims 27 and 41 have been amended to remove the term “type” to clarify the meaning of the claims.

With respect to Claim 27, the combination of references does not disclose every limitation of the independent Claim 20. Additionally, Claim 27 recites “the valve being configured such that, when fully opened, it defines an opening substantially equal in width to an inner surface of the piping, and the valve does not have projections, when fully opened, with respect to the inner surface of the piping.” However, the valve of Fujimura is configured “so that the inner pressure of the plasma generating chamber was well maintained.” A “through-flow valve” would not be able to maintain the pressure. When the valve is opened, the pressure in the remote plasma chamber is substantially similar to the pressure in the CVD chamber. Claim 42 even more specifically recites that the pressure drop is “less than about 5% of a pressure at an inlet to the chamber.” Thus, the valve of Fujimura is not a “through-flow” valve.

Applicants believe that the rejections of Claims 27 and 41 have been overcome. Additionally, Claims 28 and 42-44 add features of further particular utility and should be allowed.

Conclusion

Noble does not teach all of the limitations of the present claims, either alone or combined with Iyer and Fujimura. As the combination of references fails to teach each and every element recited in Applicants’ claims, the Examiner’s anticipation rejections are traversed. Thus, Applicants submit that the claims as amended are now in condition for allowance and respectfully request the same.

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Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: Nov. 5, 2004

By: 

Brian Leubitz
Registration No. 54,264
Attorney of Record
Customer No. 20,995
(415) 954-4114

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